CLIMATIC SUMMARY FOR THE PACIFIC MISSILE TEST CENTER

Robert de Violini

Pacific Missile Test Center
Point Mugu, California

25 April 1975

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By

ROBERT de VIOLINI
Geophysics Division

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A brief summary of climatic data for Point Mugu and San Nicolas Island, California, and for Barking Sands, Kauai, Hawaii, is provided to assist the range user in planning operations at the Pacific Missile Test Center (formerly the Pacific Missile Range). The information presented are those basic weather data often of interest in the initial planning stages: temperature, precipitation, wind, sky cover, visibility, and flying weather. The PMTC Geophysics Division should be contacted if more detailed information regarding any of these locations is required.

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INTRODUCTION

The Geophysics Division of the PMTC (Pacific Missile Test Center), Point Mugu, California, provides meteorological, oceanographic, geodetic, and other geophysical services to users of PMTC facilities. Highly trained specialists maintain the routine operations of the division, support operations on the PMTC ranges, and are available to all range users for consultation.

Point Mugu is the primary location for which climatic data are available at PMTC. A weather facility is also operated by the Geophysics Division at San Nicolas Island in the Sea Test Range, and another is operated at the Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii.

This brochure is designed to provide the range user with some of the basic environmental information needed in planning operations and presents a general overview of climatic conditions for Point Mugu and San Nicolas Island. A brief look at climatic conditions at Barking Sands is also given.

More detailed information regarding environmental conditions at these facilities and other locations of interest, may be obtained by contacting the PMTC Geophysics Division.

PACIFIC MISSILE TEST CENTER FACILITIES

Point Mugu Complex

Location

Point Mugu, site of the PMTC Headquarters, is located on the southeastern edge of the Oxnard Plain at 34°07′ north latitude, 119°07′ west longitude. The cities of Oxnard and Ventura are about 8 and 12 miles, respectively, to the northwest; and Camarillo is 9 miles to the north-northeast. The Los Angeles Civic Center lies 53 miles to the east-southeast.

Local Topography

The average elevation of Point Mugu is 12 feet MSL (mean sea level). The terrain rises gradually north and northwest to the foothills of the Topa Topa mountains. Two miles to the east lie the principal terrain features of the area: Laguna Peak (1,457 feet) and La Jolla Peak (1,567 feet). The hills on the eastern side of these two peaks merge into the Santa Monica mountains which are generally 2,000 to 3,000 feet in altitude. Other inland mountain ranges within 40 miles of Point Mugu attain heights of over 8,000 feet.

The coast of southern California, between Point Arguello and Point Loma, forms a great embayment comprised of the Santa Barbara Channel indentation, Santa Monica Bay, and the Gulf of Santa Catalina. Within this embayment the ordinarily narrow continental shelf extends out to sea 120 miles farther than at Point Arguello. Rising from this relatively broad platform is a chain of eight major islands scattered over an area of some 5,000 square miles and extending 130 nautical miles in a generally northwest to southeast direction.

These islands are often designated as the "Channel Islands" and are commonly differentiated into two groups: a northern group consisting of San Miguel Island, Santa Rosa Island, Santa Cruz Island, and Anacapa Island; and a southern group consisting of San Nicolas Island, Santa Barbara Island, Santa Catalina Island, and San Clemente Island.

Anacapa Island, approximately 15 nautical miles to the west, and Santa Cruz Island, approximately 35 nautical miles to the west, are often visible from Point Mugu. Anacapa Island is the site of a U.S. Coast Guard lighthouse station, while Santa Cruz Island is the largest and the highest of the chain (2,471 feet). San Nicolas Island, site of much range instrumentation and an auxiliary landing field, lies 55 nautical miles south-southwest of Point Mugu and 66 nautical miles southwest of Los Angeles (see figure 1).

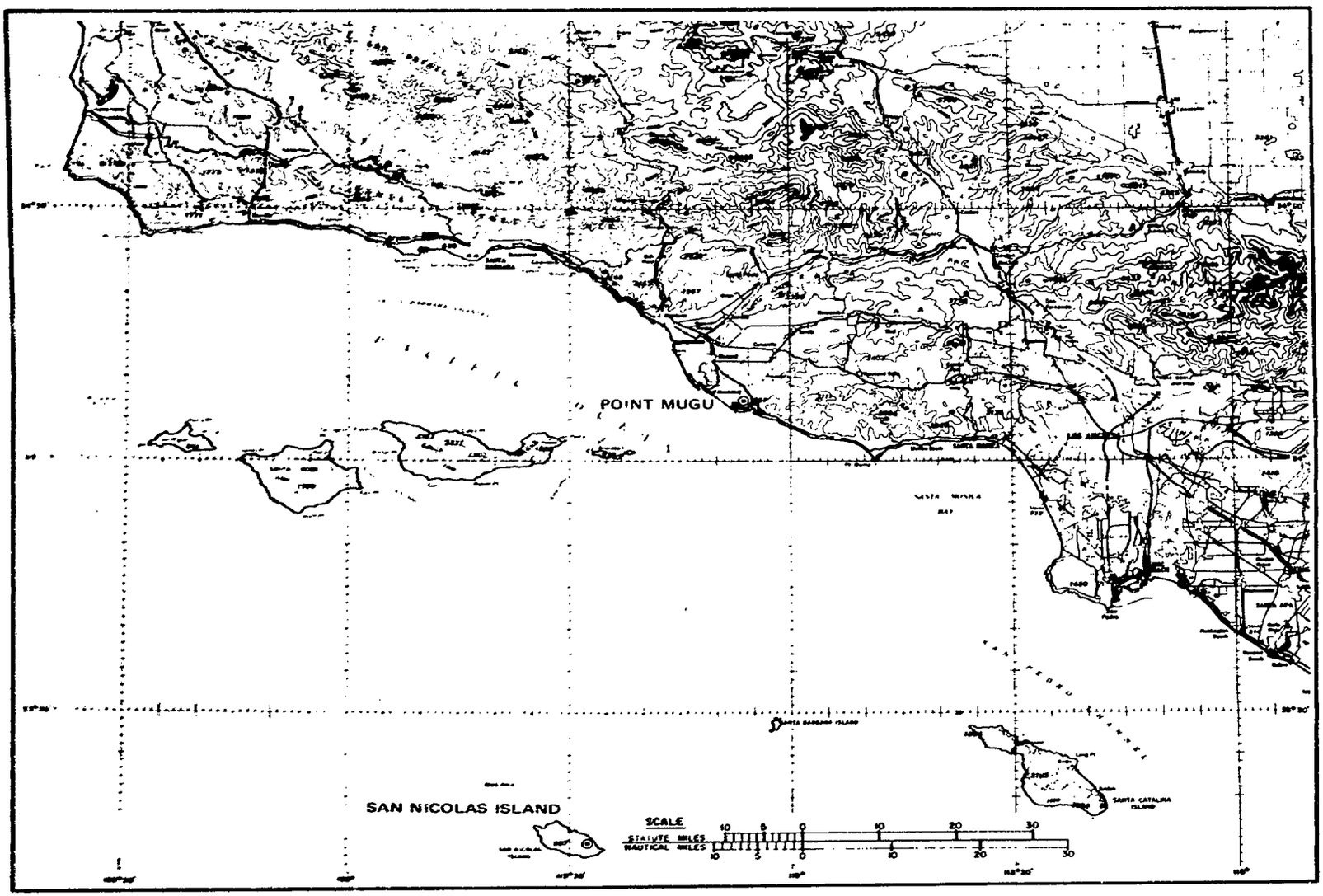
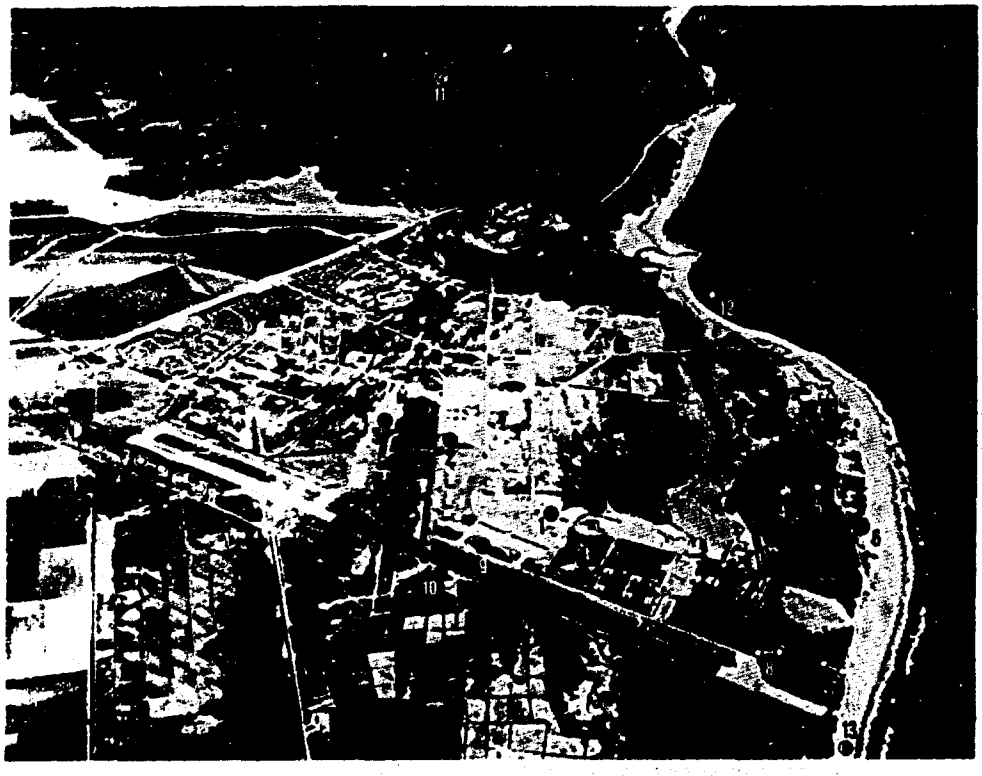


Figure 1. Southern California Coast and Channel Islands.

Station Background

The first observations of surface weather conditions at Point Mugu were made by Naval Weather Service personnel in early 1946, and continuous records of such observations extend from that fall. Weather observations were made in the vicinity of building 3-5 until about 1950, and at building 34 from 1950 to early 1966 when the observers' location was moved to building 552. Much of the weather instrumentation was first installed in proximity to building 34; however, as measurement techniques improved, other locations were chosen for new sensors. The present location of most of the meteorological instrumentation at Point Mugu is indicated in figure 2.



1. GEOPHYSICS DIVISION BUILDINGS; PRESENT LOCATION OF WEATHER OBSERVER.
2. OBSERVER LOCATION, 1950 THROUGH 1966.
3. OBSERVER LOCATION, 1946 THROUGH 1950.
4. RADIOSONDE BALLOON INFLATION SHELTER AND RELEASE POINT.
5. WIND TOWER (150 FEET).
6. METEOROLOGICAL ROCKET LAUNCH SITES.
7. ROTATING BEAM CEILOMETERS (CLOUD-HEIGHT SETS).
8. TRANSMISSOMETERS (RUNWAY VISIBILITY).
9. TEMPERATURE AND DEW POINT SENSORS.
10. WIND SPEED AND DIRECTION SENSORS.
11. TEMPERATURE, DEW POINT, AND WIND SENSORS; LAGUNA PEAK.
12. SEA WATER TEMPERATURE SENSOR.
13. SITE OF ATMOSPHERIC ELECTRICITY STATION, 1964 THROUGH 1966.

Figure 2. Location of Geophysics Division Equipment at Point Mugu.

General Weather Description

Point Mugu is subject to the typical southern California coastal weather cool summers and mild winters with a relatively small range of mean monthly temperatures throughout the year. The three major factors influencing the climate of Point Mugu are the semipermanent subtropical Pacific High which keeps most storms to the north of Point Mugu except between late fall and early spring, the proximity of the Pacific Ocean (less than 3 miles to the south and east from most parts of the station), and coastal mountains extending from the northwest to the east forming a boundary to the Oxnard Plain.

Marine air covers the coastal sections of southern California during most of the year, but air from the interior desert regions occasionally reaches Point Mugu, particularly during the fall and winter months. The coastal mountain ranges act as a buffer in keeping the warmer air out and as a direction-channeling influence when the desert air flows over the hills and down the passes during Santa Ana wind occurrences.

The most characteristic feature of this area's climate is the night and early morning low cloudiness and sunny afternoons that prevail during the spring and summer months, and often occur during the remainder of the year as well. On a year-round basis, flying weather is above VFR (Visual Flight Rule) minimums (1,000-foot ceiling and 3-mile visibility) over 80 percent of the time, with March and April reaching the 90-percent level and July and August reporting less than 70-percent VFR weather. At the other end of the spectrum, the ceiling and visibility are below the lowest instrument landing minimums (100 feet or 1/4 mile) only 1.8 percent of the time on an annual average. The greatest monthly occurrence of such conditions is 3.5 percent in October; the lowest is 0.6 percent in May.

The coastal low cloudiness combines with the westerly sea breezes and the cool maritime air masses to keep temperatures mild throughout much of the year. The daily temperature range is about 13 degrees in spring and summer and about 18 degrees in fall and winter. The mean monthly temperatures run from a low of about 53 degrees in January up to a high of about 64 degrees in August. As in most of southern California, the warmest temperatures usually occur in late summer and early fall, with daily temperature maxima in the upper 80s and low 90s not uncommon. The extremes of temperature, based on records that extend back to 1946, were both set in 1971. The all time minimum of 27°F occurred in February and the all time maximum of 104°F occurred in October of that year. This maximum was only the fifth time in the past 25 years that the temperature reached 100 degrees or better, but subfreezing temperatures have been observed in eight of the past 25 winters.

Prevailing daytime surface winds are from the west at 8 to 12 knots, and become northerly in the evening hours at 3 to 5 knots. During most of the year, the coastal mountains act as a buffer between the marine air over coastal southern California and the drier air over the desert regions. However, when high pressures build up over the interior basins in fall and winter, the passes and canyons of these same ranges act as channels that direct the flow of air from the desert toward the sea. This situation results in the Santa Ana, 2- to 3-day periods of strong, gusty, and dry northeasterly winds. In these conditions, the skies are generally clear, but there can be much blowing dust that at times can restrict the otherwise excellent visibility to a few miles. The relative humidity drops to less than 20 percent and the fire danger in the brush-covered hillsides rises to extreme levels.

The strongest surface winds observed at Point Mugu have either occurred during these northeasterlies, or were from the southeast ahead of an active cold front in the fall and winter, or were from the west in spring when a deep low has developed over southern Nevada. Peak gusts have been in the 35- to 45-knot range.

Precipitation is mostly a wintertime phenomenon, with over 85 percent of the average season total (10.5 inches) falling from November through March. Summer precipitation is most often in the form of early morning drizzle, and typically leaves only trace amounts.

Although snow is an almost yearly occurrence in the higher mountains of Ventura County, it has fallen and remained on the ground as snow only once at Point Mugu. In 1949, nearly 2 inches fell during the night of 10 to 11 January and melted by the afternoon of the 11*th*. Trace amounts of snow that melted as it fell have been reported on a few other occasions.

Thunderstorms are not unusual at Point Mugu, but they are uncommon. They occur only 5 or 6 days of each year, either in summer when moist unstable tropical air is carried over southern California from the warm source regions off the coasts of Mexico, or in fall and winter during a particularly active frontal passage. Hail is infrequent, usually small, and of short duration. On occasion, small funnel clouds are noted during weather situations favoring a very unstable air mass. These are usually seen offshore as potential waterspouts.

Surface visibility is most often restricted by fog and haze in the early morning hours and improves during late morning. However, in the afternoon, smog (usually logged as smoke and haze) transported up the coast from the Los Angeles basin on southeasterly winds frequently restricts visibility regardless of the season.

Because of its nearness to the coastline, Point Mugu's relative humidity is high. The annual average is 75 percent and all months have many occurrences of 100 percent in the morning hours. During the Santa Ana winds, however, the humidity will drop to less than 30 percent and often remain below 20 percent for a major portion of the day.

A brief climatic summary for Point Mugu is provided in table 1.

Table 1. Point Mugu Surface Climatic Summary

Month	Temperature (°F)				Precipitation (Inches)			Humidity (Percent)			Surface Winds (Knots)			Mean Sky Cover (Tenths)
	Average		Extreme		Average Amount	Extreme		Average		Extreme	Prevailing Direction	Average Speed	Peak Gust Direction/Speed	
	Max.	Min.	Max./Year	Min./Year		Max./Year	Min./Year	Max.	Min.	Min./Year				
January	62.0	43.8	88/1965*	29/1970	2.53	11.57/1969	0.02/1948	86	47	4/1961	NE	10	ENE/45	4.1
February	62.9	44.8	89/1971	27/1971	2.02	13.85/1962	Trace/1964*	89	49	2/1955	W	9	ENE/49	4.3
March	62.3	45.1	87/1951	33/1971*	1.18	4.52/1958	0.00/1959	92	54	3/1956	W	10	W/43	4.4
April	63.5	48.0	99/1966	34/1955	0.90	4.23/1965	Trace/1973*	93	59	12/1971*	W	10	W/50	4.2
May	64.8	51.1	96/1970	39/1950	0.13	0.99/1955	Trace/1973*	93	63	8/1960	W	9	NE/39	4.8
June	67.2	54.2	100/1957	42/1971*	0.03	0.26/1963	Trace/1973*	94	67	9/1957	W	8	W/29	5.8
July	70.0	56.9	88/1960	41/1948	0.01	0.13/1969	0.00/1947	96	68	34/1960	W	7	SSE/27	5.1
August	71.7	58.0	97/1972	46/1948	0.01	0.12/1947	0.00/1971*	95	67	29/1972	W	8	W/24	5.1
September	71.8	56.7	97/1965*	39/1948	0.06	0.57/1963	0.00/1957	93	63	5/1958	W	7	NE/40	4.8
October	70.1	52.7	104/1971	33/1971	0.19	0.90/1957	Trace/1970*	91	58	7/1971*	W	7	NE/41	4.4
November	67.7	48.6	98/1966	31/1958	1.82	6.42/1965	0.00/1956	88	50	4/1961*	NE	7	SE/42	4.7
December	63.8	45.2	89/1958	28/1971	1.63	5.33/1971	0.05/1962	87	43	3/1959*	N	5	NE/44	4.0
Year	**66.5**	**50.4**	**104/10/71**	**27/2/71**	**10.50**	**21.87/1961-2 Season**	**4.82/1958-9 Season**	**91**	**57**	**2/2/55**	**W**	**8**	**W/50**	**4.6**

*Also occurred in earlier year or years.

NOTE. Periods of record are as follows.

Temperature: Averages, January 1947 to December 1972; Extremes, March 1946 to December 1972.

Precipitation: Averages, July 1946 to June 1973; Extremes, July 1946 to June 1973.
A trace is an amount too small to measure (< 0.01 inch).

Humidity: Averages, January 1952 to December 1972. Extremes, January 1952 to December 1972.
All months have reported 100 percent relative humidity

Surface Wind: Averages, March 1960 to December 1972; Extremes, July 1962 to December 1972.
Prevailing wind direction and average wind speed are the most frequently observed wind direction and the average speed from that direction. (In July 1962, the AN/UMQ-5 wind equipment at Point Mugu was relocated from tower locations near 90 feet AGL to the present runway location at 12 feet AGL. Surface winds reported since that date are substantially lower than those recorded in earlier years due to this relocation and are considered more representative of true surface conditions.)

Sky Cover: January 1960 to December 1969.
Zero-tenths is clear, ten-tenths is overcast.

Monthly Values of Sky Cover and Visibility

A knowledge of the frequency of certain sky conditions (cloud cover) and of certain visibility values is needed for operations requiring optical tracking. The monthly frequency of occurrence of cloud amount at Point Mugu, in the standard meteorological classes (clear, scattered, broken, and overcast), and also in the lay terms often used in forecast preparation (clear, partly cloudy, and cloudy) is given in table 2. Table 3 shows the monthly frequency of occurrence of horizontal visibility values of under 1/2 and under 1 mile, and at least 3, 6, and 10 miles.

Table 2. Percent Frequency of Given Sky Conditions at Point Mugu

Month	Sky Conditions						
	Clear	Scattered	Broken	Overcast	Clear*	Partly Cloudy*	Cloudy*
January	36.0	25.1	18.1	20.8	48.9	21.1	30.0
February	35.4	23.7	16.8	24.1	47.2	18.6	34.3
March	30.4	27.5	21.1	21.0	44.5	22.1	33.4
April	34.4	26.2	17.3	22.1	48.7	19.2	32.1
May	32.1	22.9	15.4	29.6	43.0	18.2	38.8
June	26.5	16.8	14.4	42.3	34.9	13.8	51.3
July	31.5	19.0	15.8	33.7	40.6	15.9	43.5
August	29.4	22.0	16.2	32.4	40.2	18.2	41.6
September	36.3	17.0	13.3	33.4	45.8	12.8	41.4
October	36.5	22.2	15.7	25.6	47.0	18.2	34.8
November	31.0	24.2	21.0	23.8	42.7	21.1	36.2
December	38.4	24.6	17.4	19.6	50.4	20.3	29.3
Year	**33.2**	**22.6**	**16.8**	**27.4**	**44.6**	**18.2**	**37.2**

Clear	No clouds (0/10 cover)
Scattered	Scattered clouds (1/10 through 5/10 cover)
Broken	Broken clouds (6/10 through 9/10 cover)
Overcast	Overcast clouds (10/10 cover)

Clear:	0/10 through 2/10 cloud cover
Partly Cloudy:	3/10 through 7/10 cloud cover
Cloudy:	8/10 through 10/10 cloud cover

*Lay terms

Table 3. Percent Frequency of Selected Visibility at Point Mugu

Note: All visibility values reported in statute miles.

Month	Visibility Frequency (Percent)				
	< 1/2 Mile	< 1 Mile	≥ 3 Miles	≥ 6 Miles	≥ 10 Miles
January	1.8	2.7	90.3	78.9	68.9
February	2.3	4.4	88.5	78.1	65.9
March	1.9	2.9	92.9	80.9	66.5
April	2.1	3.2	93.0	82.3	65.5
May	1.3	2.4	90.7	77.1	55.4
June	1.7	4.3	84.0	64.7	40.7
July	2.4	4.4	82.3	54.9	29.7
August	3.6	6.8	78.9	52.4	25.8
September	3.6	5.8	81.5	57.7	30.0
October	4.8	7.2	80.7	60.1	42.2
November	2.5	4.0	87.3	70.9	56.4
December	2.7	4.6	87.6	74.6	63.8
Year	**2.6**	**4.4**	**86.5**	**69.3**	**50.8**

Flying Weather

The frequency of exceeding the VFR ceiling and visibility minima of 1,000 feet and 3 miles is needed in planning aircraft and missile operations. Similarly, the occurrence of weather conditions that are below certain other ceiling and visibility minima is also often needed.

Table 4 presents the following frequencies for Point Mugu: VFR occurrence, occurrence of weather below the TACAN (Tactical Air Navigation) minima of 300 feet and 1 mile, and weather below PAR (Precision Approach Radar) minima of 100 feet and 1/4 mile. These are listed by three-hour time periods within each month where the period "0000 to 0200," for example, includes hourly observations made at 0000, 0100, and 0200 PST (Pacific Standard Time). Table 4 also includes the mean monthly values, and a graphic presentation of these monthly values is presented in figure 3.

Table 4. Frequency of Occurrence of Ceiling and Visibility Values Critical to Aircraft Operations at Point Mugu

Note: Values given in percent.

Time (PST)	VFR	Below TACAN	Below PAR	VFR	Below TACAN	Below PAR	VFR	Below TACAN	Below PAR	VFR	Below TACAN	Below PAR
	January			February			March			April		
0000 to 0200	87.6	4.9	3.4	86.7	5.8	2.4	89.3	4.7	2.4	88.1	5.7	2.7
0300 to 0500	87.4	4.6	3.4	85.5	6.5	4.0	87.1	6.9	3.9	86.4	7.1	5.0
0600 to 0800	86.2	4.4	2.1	85.2	8.2	3.1	85.4	7.0	2.7	84.1	5.6	2.8
0900 to 1100	86.7	2.6	0.5	89.2	6.4	0.8	90.5	2.1	0.0	90.4	2.6	0.2
1200 to 1400	89.5	0.9	0.0	87.6	2.4	0.2	93.2	0.6	0.0	92.4	1.2	0.1
1500 to 1700	91.0	0.7	0.1	88.7	2.1	0.3	93.6	0.4	0.0	94.6	1.0	0.0
1800 to 2000	90.1	2.0	0.4	88.5	2.9	1.4	92.3	2.1	0.0	92.8	2.9	0.9
2100 to 2300	88.4	3.3	1.7	88.2	4.4	2.4	91.2	3.1	1.6	90.2	3.3	1.4
All Hours	**88.4**	**2.9**	**1.5**	**86.1**	**4.8**	**1.8**	**90.3**	**3.4**	**1.3**	**89.9**	**3.7**	**1.6**
	May			June			July			August		
0000 to 0200	81.5	4.6	0.9	68.6	9.0	1.4	59.5	10.4	2.3	58.3	12.8	3.8
0300 to 0500	77.6	6.3	1.8	59.9	12.1	2.2	45.6	15.5	4.5	48.3	20.7	7.0
0600 to 0800	75.5	5.2	0.9	57.6	11.6	1.9	42.4	14.7	4.1	45.0	20.7	4.4
0900 to 1100	84.6	1.3	0.0	72.7	3.2	0.1	69.1	1.3	0.0	66.8	2.7	0.0
1200 to 1400	91.9	0.2	0.0	82.9	0.2	0.0	81.0	0.4	0.0	79.1	1.2	0.0
1500 to 1700	92.7	1.0	0.0	87.9	0.2	0.0	89.4	0.4	0.0	85.0	1.2	0.0
1800 to 2000	88.5	3.9	0.9	80.3	3.6	0.2	80.9	3.5	0.0	75.2	2.5	0.2
2100 to 2300	86.2	4.2	0.3	75.3	9.2	1.1	73.2	5.2	1.0	70.3	7.6	1.4
All Hours	**84.8**	**3.3**	**0.6**	**73.1**	**6.0**	**0.9**	**67.6**	**6.4**	**1.5**	**66.0**	**9.7**	**2.1**
	September			October			November			December		
0000 to 0200	65.9	10.0	4.4	71.7	11.2	6.3	82.4	7.1	4.0	83.3	7.3	4.0
0300 to 0500	59.1	15.7	7.4	71.5	14.0	8.2	82.2	7.7	5.0	83.9	6.7	3.9
0600 to 0800	52.2	15.4	5.6	63.4	16.1	3.4	78.1	8.2	3.2	82.3	7.0	2.8
0900 to 1100	73.2	2.7	0.1	76.6	4.2	0.4	83.4	3.6	0.4	83.6	4.1	1.0
1200 to 1400	87.4	0.7	0.0	85.5	1.5	0.2	89.8	1.3	0.2	88.9	2.8	0.1
1500 to 1700	87.1	1.2	0.0	88.4	2.0	0.4	89.8	1.4	0.1	89.6	3.1	1.1
1800 to 2000	79.3	6.7	0.2	83.4	5.5	2.1	89.4	2.0	0.8	86.0	4.6	2.3
2100 to 2300	74.6	6.3	2.6	78.5	7.8	4.1	83.0	3.8	2.1	84.7	4.5	1.9
All Hours	**72.4**	**7.0**	**2.4**	**77.3**	**7.8**	**3.5**	**84.8**	**4.4**	**2.0**	**85.3**	**6.0**	**2.1**

VFR = ≥1,000-foot ceiling and 3-mile visibility — Year: VFR = 80.5

TACAN minimums = 300-foot ceiling and 1-mile visibility — <TACAN = 5.4

PAR minimums = 100-foot ceiling and 1/4-mile visibility — <PAR = 1.8

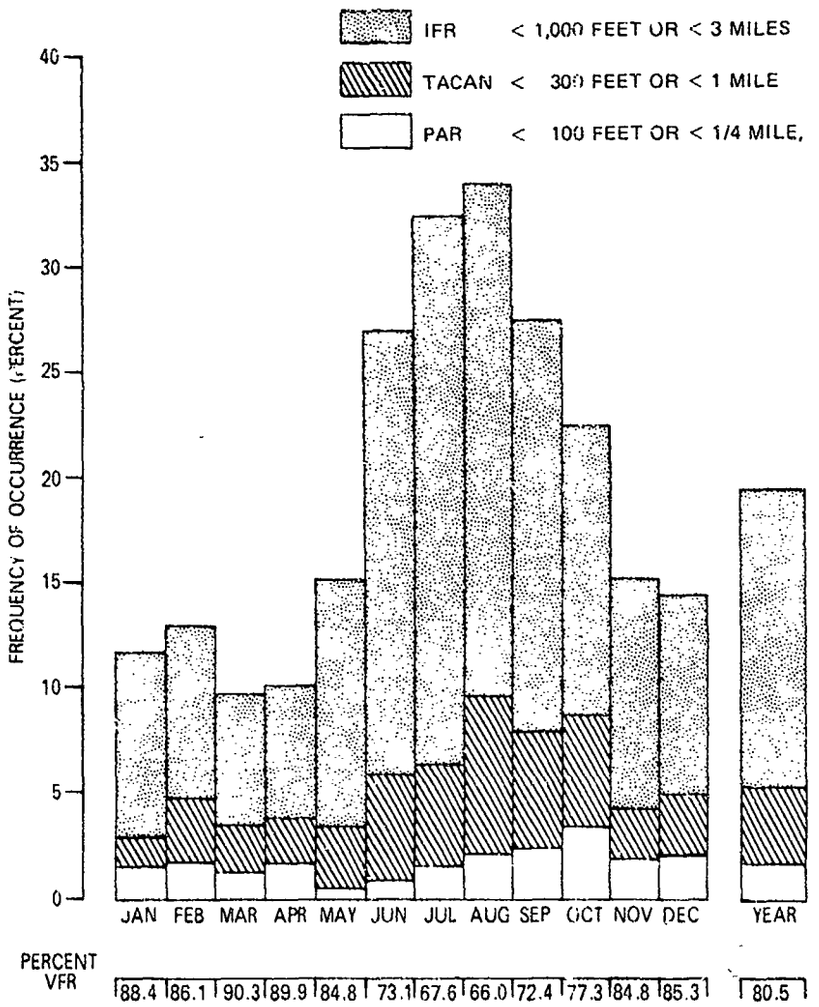


Figure 3. Frequency of Ceiling and Visibility Values Critical to Aircraft Operations at Point Mugu.

San Nicolas Island

Location

San Nicolas Island, an operating site of the PMTC, is located 55 nautical miles south-southwest of Point Mugu at 33°15′ north latitude, 119°28′ west longitude. The closest land is Santa Barbara Island, 25 miles to the northeast. The remaining Channel Islands lie 50 to 60 miles to the north, and about 50 miles to the east and southeast of San Nicolas Island. Los Angeles is about 65 miles to the northeast.

Local Topography

San Nicolas Island lies with its longest dimension (about 8.5 miles) along a west-northwest–east-southeast axis, and is roughly elliptical in shape. With a greatest width of about 3 miles, its area is just over 20 square miles. From the sea, the island has a distinctly table-like profile. Its peak height of 907 feet MSL is located near the central portion of the southern edge of the mesa.

The mesa slopes gently downward toward the north-northeast from a general height of about 850 feet to about 450 feet along its northern edge. The mesa falls off abruptly on its southern, eastern, and northern sides into deeply eroded canyons. The most precipitous descents occur to the south and east, with drops of about 750 feet in 1 mile (a 14-percent grade) and about 300 feet in 1/5 of a mile (a 28-percent grade), respectively. The slope to the western end of the island is much more gradual, and many of the canyons are filled with constantly shifting sand dunes.

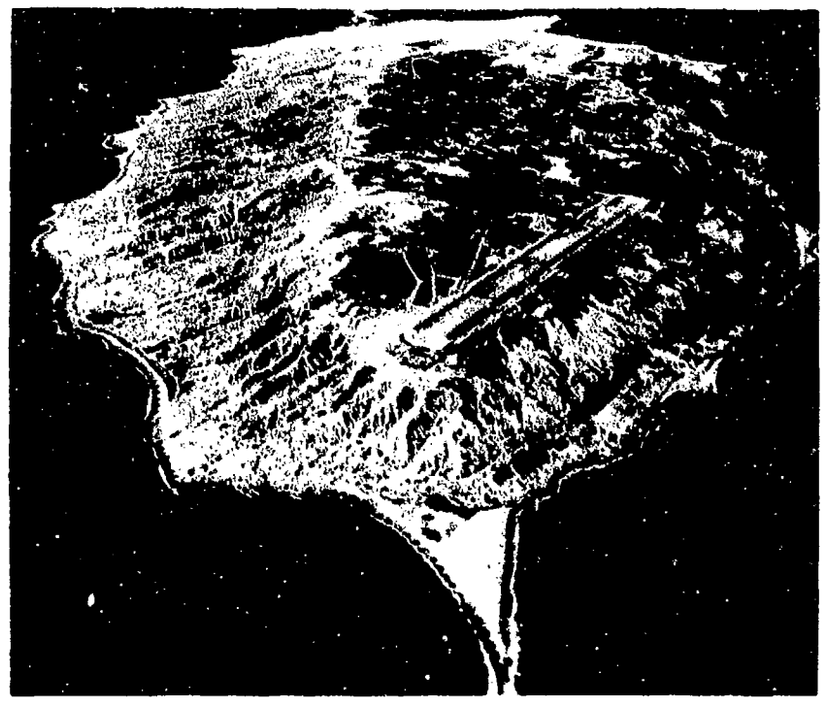
The major topographical feature of the northwestern end of San Nicolas Island is Vizcaino Point [figure 4(a)], the western side of which is the seasonal home of several thousand sea lions. For many years the eastern end of the island has been marked by a long sand spit [figure 4(b)], and its shape has been constantly changing. Maps of the 1851 to 1879 era show no sand spit, but reports from about 1910 onward indicate the existence of this feature, with general growth through the early 1940s. In the 1950s, it began to shorten, and at the present time the sand spit has virtually disappeared.

An auxiliary landing field is located on the eastern portion of the mesa at a height of 504 feet MSL. The weather facility is adjacent to the runway at 564 feet MSL. It is to this location that the weather data presented here should be referenced. Because the station is not at sea level, it frequently is within the subtropical marine inversion that affects southern California weather patterns for most of the year. Thus many of the meteorological measurements are not necessarily representative of conditions existing at sea level, and caution is advised in applying these data.

Station Background

The Navy was given jurisdiction over San Nicolas Island by Executive Order of President Hoover in January 1933. In August of that year, a weather station was established by the Navy, with observations sent to the U.S. Weather Bureau office in San Francisco. These data, primarily of temperatures and precipitation, exist for the period September 1933 through August 1944, at which time the station was closed.

(a) From the Northwest With Vizcaino Point in the Foreground.



(b) From the Southeast. At this writing, sandspit has virtually disappeared.

Figure 4. San Nicolas Island.

In November 1942, the Army was given temporary jurisdiction over the island, and it then became a gunnery and bombing range. It was returned to the Navy following the end of World War II and, in 1947, San Nicolas Island came under the control of the Naval Air Station, Point Mugu, as part of the Naval Air Missile Test Center. Continuous records for the island date from that year.

Surface observations have been made from a site 507 feet above MSL and adjacent to the runway since at least the mid-1940s. Over the years, the major portion of the surface weather observations have been made between 0600 and 1800 PST. Thus, in the monthly frequencies and monthly means, there is a very strong bias toward daytime conditions. In addition, a large portion of the island cannot be seen from the observation site, and the resulting data do not necessarily portray the weather over the entire island.

General Weather Description

Except for steady northwesterly winds and lower annual rainfall, San Nicolas Island experiences much the same general weather patterns as does Point Mugu; however, the island presents an obstruction to the prevailing wind flow. Thus, if stratus clouds are present over the adjacent waters, the northern slopes may be covered by these low clouds, while the southern portions of the island may be clear. Additionally, small vortices may develop in the airflow, creating occasional clear spots within the clouds downwind of the island.

The flying weather at San Nicolas Island is above VFR minimums (1,000-foot ceiling and 3-mile visibility) 78 percent of the time on a year-round basis, with the best month being March (88 percent) and the worst month July (65 percent). Annually the ceiling and visibility are below the lowest instrument landing minimums (100 feet or 1/2 mile) 3.3 percent of the time; March and July again are the best and worst months, respectively.

The moderating effect of the surrounding ocean is seen in the small range of mean monthly temperatures. They vary from 54 degrees in January to 64 degrees in September, the warmest month. Daily maximum temperatures are near 70 degrees in the warmest months and near 60 degrees in the coolest months. Minimum temperatures generally vary from the upper 40s to the mid-50s through the year. Freezing temperatures have not been recorded, but several days with maxima over 100 degrees have occurred; the highest was 105 degrees in September of 1955.

The average seasonal precipitation is just over 6.5 inches, with 73 percent of this amount falling from November through February. The summer months average less than 0.1 inch, and most of what falls is drizzle from stratus clouds. The occurrence of thunderstorms, hail, and funnel clouds is much the same as at Point Mugu infrequent. Visibility restrictions, however, are much more likely to be fog and haze, although the island may experience lowered visibility at times as a result of smog from the Los Angeles area.

A brief climatic summary for San Nicolas Island is provided in table 5.

Table 5. San Nicolas Island Surface Climatic Summary

Month	Temperature (°F)				Precipitation (Inches)			Humidity (Percent)			Surface Winds (Knots)			Mean Sky Cover (Tenths)
	Average		Extreme		Average Amount	Extreme		Average		Extreme	Prevailing Direction	Average Speed	Peak Gust Direction/Speed	
	Max.	Min.	Max./Year	Min./Year		Max./Year	Min./Year	Max.	Min.	Min./Year				
January	59.3	48.1	84/1962	33/1949	1.27	4.61/1952	0.03/1972	86	59	15/1969*	NW	12	WNW/52	4.6
February	60.5	48.8	83/1971	37/1969*	1.21	5.45/1962	Trace/1961	88	60	16/1967	NW	14	NW/40	4.5
March	59.8	48.2	79/1960*	34/1951	0.76	3.12/1958	0.00/1959	88	59	10/1955	NW	15	WNW/43	4.6
April	62.4	49.6	96/1968	38/1948	0.64	2.68/1965	Trace/1972*	87	58	10/1955	NW	15	NW/42	4.3
May	63.2	51.0	100/1970	38/1959	0.06	0.48/1971	0.00/1962	90	64	12/1956	NW	16	WNW/42	5.2
June	65.1	53.1	96/1957	41/1948	0.02	0.16/1951	0.00/1968*	93	66	11/1957	NW	14	WNW/45	5.4
July	68.7	55.6	96/1957	44/1951	0.01	0.13/1950	0.00/1970*	94	65	14/1968*	NW	13	NW/45	5.1
August	70.2	56.8	95/1967	47/1969	Trace	0.08/1972	0.00/1970*	94	63	12/1967	NW	13	WNW/41	4.6
September	71.1	57.7	105/1955	46/1948	0.04	0.44/1963	0.00/1970*	89	59	8/1970*	NW	13	WNW/39	4.5
October	68.8	52.7	100/1970*	40/1971	0.14	1.61/1957	0.00/1967*	86	57	10/1970*	NW	12	NW/41	4.0
November	65.2	52.6	89/1949	38/1958	1.18	5.63/1965	Trace/1959*	86	58	8/1959	NW	12	N/38	4.2
December	60.6	49.4	86/1958	35/1972	1.01	4.20/1951	0.00/1953	85	58	8/1958*	NW	12	NW/42	4.0
Year	**64.6**	**52.0**	**105/9/55**	**33/1/49**	**6.55**	**13.49/1951-2 Season**	**2.63/1960-1 Season**	**88**	**61**	**8/11/59***	**NW**	**14**	**WNW/52**	**4.6**

*Also occurred in earlier year or years

NOTE Periods of record are as follows

Temperature Averages, January 1948 to December 1972. Extremes, January 1948 to December 1972.

Precipitation Averages, July 1949 to June 1973; Extremes, January 1949 to June 1973.
A trace is an amount too small to measure (<0.01 inch).

Humidity Averages, January 1955 to December 1972; Extremes, January 1955 to December 1972.
All months have reported 100 percent relative humidity.

Surface Wind Averages, November 1947 to December 1972; Extremes, July 1963 to December 1972.
Prevailing wind direction and average wind speed are the most frequently observed wind direction and the average speed from that direction.

Sky Cover January 1960 to December 1969.
Zero-tenths is clear, ten-tenths is overcast.

Monthly Values of Sky Cover and Visibility

The monthly frequency of occurrence of cloud amount at San Nicolas Island in the standard meteorological classes (clear, scattered, broken, and overcast), and also in the lay terms often used in forecast preparation (clear, partly cloudy, and cloudy) is given in table 6. Table 7 gives the monthly frequency of occurrence of horizontal visibility values of under 1/2 and under 1 mile, and at least 3, 6, and 10 miles.

Table 6. Percent Frequency of Given Sky Conditions at San Nicolas Island

Month	Sky Conditions						
	Clear	Scattered	Broken	Overcast	Clear*	Partly Cloudy*	Cloudy*
January	31.1	25.7	18.4	24.9	42.7	22.6	34.7
February	33.0	24.9	17.6	24.5	43.9	21.4	35.0
March	31.1	24.5	21.3	23.1	42.8	23.1	34.1
April	33.8	25.8	17.3	23.1	45.3	22.1	32.6
May	27.3	23.0	16.0	33.7	39.0	18.5	42.5
June	27.0	21.2	13.8	38.0	31.6	15.5	45.9
July	26.8	23.9	15.7	32.8	40.4	17.8	41.8
August	31.7	24.7	13.6	30.0	45.2	18.0	36.8
September	35.9	21.5	12.7	29 9	47.8	15.2	37.0
October	41.1	21.3	15.1	22.8	51.2	17.4	31.4
November	34.6	26.6	16.9	21.9	47.3	20.3	32.4
December	37.5	25.6	16.0	20.9	49.5	20.1	30.4
Year	**32.6**	**24.1**	**16.2**	**27.1**	**44.6**	**19.3**	**36.1**

Clear	No clouds (0/10 cover)	Clear	0/10 through 2/10 cloud cover
Scattered	Scattered clouds (1/10 through 5/10 cover)	Partly Cloudy	3/10 through 7/10 cloud cover
Broken	Broken clouds (6/10 through 9/10 cover)	Cloudy	8/10 through 10/10 cloud cover
Overcast	Overcast clouds (10/10 cover)		

*Lay terms

Table 7. Percent Frequency of Selected Visibility at San Nicolas Island

Note All visibility values reported in statute miles.

Month	Visibility Frequency (Percent)				
	< 1/2 Mile	< 1 Mile	≥ 3 Miles	≥ 6 Miles	≥ 10 Miles
January	4 9	6 1	90 6	83 6	65 0
February	3 8	5.2	91 2	83 1	66 0
March	1 5	2 3	95 2	84 8	68.5
April	1 5	2 5	95 3	79 8	66 2
May	2 6	3 7	90.5	72 0	45 9
June	3 6	6 6	87 3	63 2	38 3
July	3 8	7 5	85 4	67 0	24 1
August	4 0	6 2	86 2	54 7	23 8
September	2 4	3 6	89 7	62 4	30 7
October	2 9	4 2	90 8	68 8	41 1
November	2 3	3 3	92 6	79 1	57 2
December	4 4	5 7	90.9	80 4	61 5
Year	**3 2**	**4.6**	**90.4**	**71.9**	**47.6**

Table 8 and figure 5 present the frequency of occurrence of VFR weather and of weather below TACAN and PAR minima at San Nicolas Island in the same manner as presented for Point Mugu. However, PAR minima at San Nicolas Island are 100 feet and 1/2 mile (the other criteria remain the same).

Table 8. Frequency of Occurrence of Ceiling and Visibility Values Critical to Aircraft Operations at San Nicolas Island

Note: Values given in percent.

Time (PST)	VFR	Below TACAN	Below PAR	VFR	Below TACAN	Below PAR	VFR	Below TACAN	Below PAR	VFR	Below TACAN	Below PAR
	January			February			March			April		
0600 to 0800	83 8	8 1	5 5	81 6	9 9	6 6	82 7	5 4	3 7	75 1	7 3	4 9
0900 to 1100	85 2	6 5	4 5	81 5	7 1	4 5	88 0	2 2	1 1	92 9	3 7	2 0
1200 to 1400	87 4	6 0	4 5	87 8	4 1	2 3	91 8	1 4	0 4	90 3	0 9	0 5
1500 to 1700	87 9	5 4	4 0	88 4	3 7	1 9	93 3	1 4	0 7	90 0	1 1	0 5
All Hours	**85 7**	**7.0**	**5 0**	**85 0**	**6.3**	**4.0**	**88.5**	**2 9**	**0.6**	**85.0**	**3.2**	**1.9**
	May			June			July			August		
0600 to 0800	64 9	10 7	6 4	50 6	18 6	10 9	37 9	22 9	12 0	37 0	22 8	11 8
0900 to 1100	76 9	4 0	1 5	67 0	4 3	1 4	62 2	5 6	1 6	63 5	4 1	1 4
1200 to 1400	87 0	0 4	0 0	83 6	0 6	0 0	84 4	0 6	0 1	86 1	0 1	0 0
1500 to 1700	88 2	0 5	0 0	87 1	0 8	0 1	87 1	0 3	0 1	89 5	0 6	0 1
All Hours	**77 6**	**5 1**	**2.7**	**69 7**	**7.4**	**3 7**	**65 0**	**9.6**	**4 4**	**66.4**	**8 6**	**4 1**
	September			October			November			December		
0600 to 0800	54 1	13 8	7 9	65 9	13 1	8 0	79 0	7 5	4 5	81 1	8 3	6 1
0900 to 1100	70 8	3 5	1 3	78 8	3 2	1 5	86 2	2 8	1 8	85 4	6 0	4 0
1200 to 1400	86 1	0 3	0 0	89 1	0 6	0 2	90 6	1 6	1 0	88 9	4 4	3 2
1500 to 1700	86 4	0 7	0 1	88 5	1 9	0 6	90 1	1 0	0 8	87 5	4 9	3 2
All Hours	**72 1**	**5 5**	**2 6**	**80 0**	**5 5**	**3 0**	**85 9**	**4 1**	**2 4**	**85 6**	**6 3**	**4 5**

VFR — ≥1 000 foot ceiling and 3 mile visibility
TACAN minimums — 300 foot ceiling and 1 mile visibility
PAR minimums — 100 foot ceiling and 1/2 mile visibility

Year		
	VFR	78 7
	TACAN	6 0
	PAR	4 0

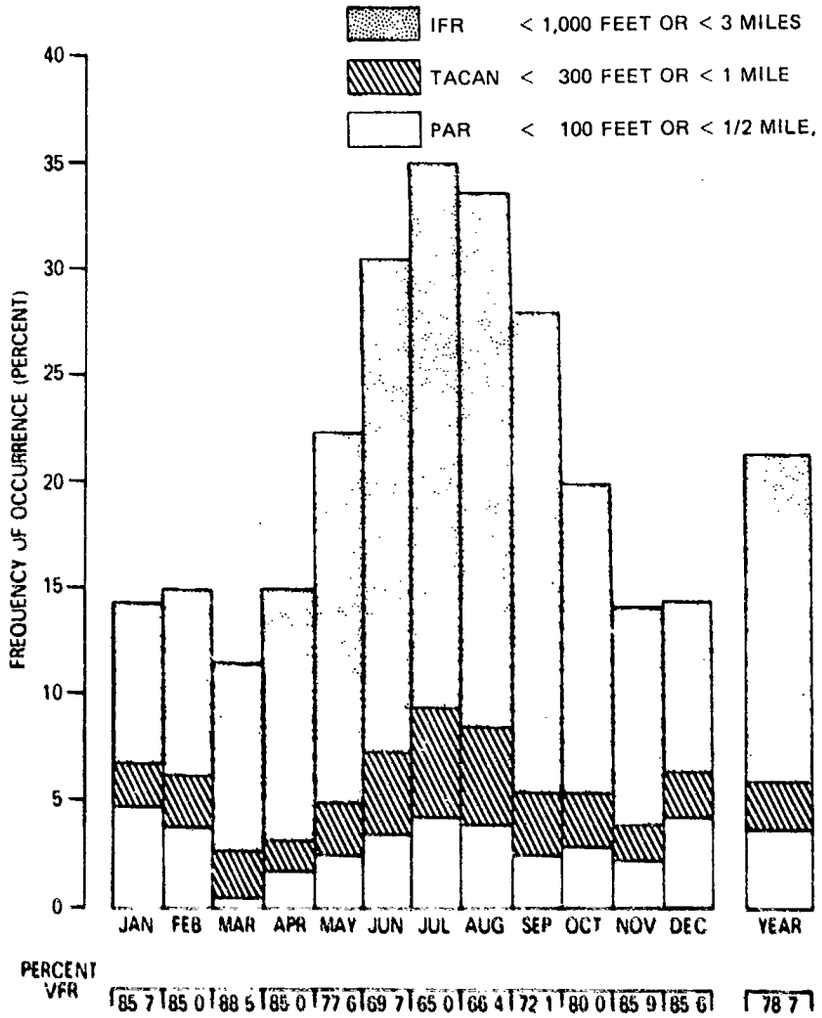


Figure 5. Frequency of Ceiling and Visibility Values Critical to Aircraft Operations at San Nicolas Island.

Barking Sands, Hawaii (Pacific Missile Range Facility)

Location and Topography

The Pacific Missile Range Facility is located at Barking Sands, on the western shores of Kauai, the westernmost major island of the Hawaiian archipelago at 22°02'N, 159°47'W, at a height of 12 feet MSL. The land is a narrow alluvial plain about 10 miles long in a north-south direction and extends two to three miles inland. The shoreline is composed of large sand dunes; to the east and north, mountains rise rapidly, reaching 2,000 feet within four miles of the station. The surrounding countryside is planted largely with sugarcane. The settlement of Mana is about one mile east of the Pacific Missile Range Facility, Barking Sands weather station.

Although the Navy has maintained a weather facility here since mid-1959, it was used primarily to provide upper-air data for various missile and spacecraft operations. Routine surface weather observations were not made until late 1967, and then primarily during the daylight hours. Thus the data presented here are biased toward that portion of the day, and are for the period from 1968 through 1973.

Locations of the meteorological facilities at Barking Sands are shown in figure 6.

General Weather Description

The trade winds are split by the island of Kauai so they flow around both sides of the island. Thus the surface winds at Barking Sands are generally light, and vary in direction as the zone of convergence of the trade wind flow shifts to the north or south of the station. However, any weather pattern that creates a tight pressure gradient along the high terrain to the northeast of the station can result in strong gusty winds from either northerly or south-southeasterly directions with speeds in excess of 30 knots.

Temperatures are generally very comfortable, with monthly maxima averaging in the upper 70s to mid 80s and monthly minima averaging in the mid to upper 60s. The daily mean temperature varies from 71 degrees in January up to 78 degrees in August and September. Extreme temperatures of 91 degrees and 53 degrees have been recorded at Barking Sands.

Sheltered from the moist trade winds by the mountain mass of the island, Barking Sands receives only about one-half the rainfall that Lihue records on the windward side. In the short period of record available for Barking Sands, the annual average amount is 21.17 inches with extremes of 35.53 and 8.42 inches.

Figure 6. Location of Meteorological Facilities at Barking Sands.

The visibility at Barking Sands is seldom below seven miles and only drops to less than three miles during periods of brief, heavy showers. At times, the seasonal burning of cane fields in the vicinity of the station can restrict the visibility, depending on the wind direction.

Some thunderstorms have occurred at Barking Sands, but they are not frequent. Only a dozen thunderstorm days were reported in the 1968 through 1973 period, and all occurred during October through January. Funnel clouds, incipient waterspouts, and small hail have also been reported in the vicinity of the facility, but these are even more infrequent than thunderstorms.

A brief climatic summary for the Pacific Missile Range Facility, Barking Sands, is shown in table 9.

Table 10 gives the monthly frequencies of cloud amount in the standard meteorological categories of clear, scattered, broken, and overcast, as well as in the more general terms of clear, partly cloudy, and cloudy. Table 11 gives the monthly frequency of visibilities of at least 10 miles and of less than 6 miles and 3 miles.

Occurrences of weather conditions below the VFR minimums of a 1,000 foot ceiling and a 3-mile visibility are rare, having been reported in not more than 0.3 percent of the observations in any one month. IFR weather has never been observed during May through September. On the few occasions when IFR weather does occur, it is more often due to low visibility than to low ceilings, and such periods are quite short-lived.

Table 9. Climatic Summary for the Pacific Missile Range Facility, Barking Sands

Month	Temperature (°F)				Precipitation (Inches)			Humidity (Percent)			Surface Winds (Knots)			Mean Sky Cover (Tenths)
	Average		Extreme		Average Amount	Extreme		Average			Prevailing Direction	Average Speed	Peak Gust Direction/Speed	
	Max.	Min.	Max./Year	Min./Year		Max./Year	Min./Year	Daily	Morning	Afternoon				
January	78	64	83/1972	54/1969	4.45	9.94/1971	0.54/1973	69	77	65	W.NNW	11	N 80	6.0
February	79	64	86/1971	52/1970	1.29	3.95/1968	0.24/1969	73	80	63	S.SSE	9	N 33	5.5
March	81	64	87/1973	56/1969	1.54	4.11/1971	0.10/1969	71	77	59	WNW.NW NNW.N	5 9	NNE 37	5.3
April	81	66	87/1973	58/1968	1.73	3.44/1972	0.08/1969	70	72	57	W.WNW NNW.N	5 8	N 44	5.6
May	83	68	87/1973	61/1972	0.36	1.75/1971	Trace/1968	68	67	58	N.NW	5	N 33	5.2
June	84	68	91/1969	63/1970	0.49	1.86/1971	Trace/1970	68	66	58	W.WNW	5	N 31	5.0
July	85	69	91/1969	66/1973	0.59	1.26/1968	0.03/1973	68	67	57	W.NW	6	NNE 29	5.0
August	85	69	90/1971	65/1972	0.44	0.97/1972	0.02/1971	67	66	57	W.WNW	6	N 29	4.9
September	85	70	89/1971	65/1969	1.29	4.43/1970	0.01/1971	67	69	60	W.WNW	6	N 26	5.4
October	83	69	91/1971	64/1973	2.56	6.30/1972	0.18/1969	69	73	62	W.WNW	5	N 33	5.2
November	82	67	87/1969	59/1969	3.46	8.89/1973	0.11/1971	70	76	62	W.WNW NNW.N	5 8	N 43	5.6
December	82	64	88/1971	53/1969	3.43	9.90/1968	0.19/1973	68	79	61	NNW.N	10	N 43	5.0
Year	82	67	91/69, 71	53/1969	21.97	35.53/1968	8.42/1969	69	72	60	W.WNW	5	N/80	5.3

NOTES: Because this station operates primarily during daylight hours, Monday through Friday only, much of the data are biased toward that portion of the day or month. Periods of record for the data presented are as follows:

Temperature: 1965 and 1968 to 1973 (Degrees F.)

Precipitation: January 1968 to December 1973 (Inches)

Humidity: 1966 to 1972. "Morning" - 0600-0700 LST (Local Standard Time); "Afternoon" - 1500-1700 LST; "Daily" - all data. (Percent).

Surface Wind: 1966 to 1972 peak gusts January 1968 to December 1973. (Directions are true, speeds are knots.) Although all peak gust directions shown here are northerly there have been many occasions of strong winds with 30- to 40-knot gusts from southerly directions.

Sky Cover: 1966 to 1972 (Tenths).
Zero-tenths = clear, ten-tenths = overcast

Table 10. Percent Frequency of Given Sky Conditions at the Pacific Missile Range Facility, Barking Sands

Month	Sky Conditions						
	Clear	Scattered	Broken	Overcast	Clear*	Partly Cloudy*	Cloudy*
January	15.9	25.9	21.1	37.1	28.3	23.7	48.0
February	23.4	22.3	22.2	32.1	35.2	19.0	45.8
March	22.9	24.4	25.9	26.8	36.0	23.6	40.4
April	16.8	28.4	26.5	28.3	34.1	25.4	40.5
May	19.6	28.9	28.4	23.1	36.0	26.5	37.5
June	19.4	32.3	30.6	17.7	34.6	31.1	34.3
July	19.5	31.4	27.7	21.4	38.6	26.3	35.1
August	18.0	34.1	30.7	17.2	36.2	30.8	33.0
September	18.9	26.9	29.5	24.7	31.9	27.5	40.6
October	22.1	28.6	21.9	27.4	36.3	22.7	41.0
November	20.3	23.6	27.0	29.1	33.4	21.3	45.3
December	25.4	25.6	22.3	26.7	38.7	21.8	39.5
Year	**20.2**	**27.7**	**26.1**	**26.0**	**34.9**	**25.0**	**40.1**

Clear: No clouds (0/10 cover)
Scattered: Scattered clouds (1/10 through 5/10 cover)
Broken: Broken clouds (6/10 through 9/10 cover)
Overcast: Overcast clouds (10/10 cover)

Clear: 0/10 through 2/10 cloud cover
Partly Cloudy: 3/10 through 7/10 cloud cover
Cloudy: 8/10 through 10/10 cloud cover

*Layer terms

Table 11. Percent Frequency of Selected Visibility Values at the Pacific Missile Range Facility, Barking Sands

Note: All visibility values reported in statute miles.

Month	Visibility Frequency (Percent)		
	≤ 3 Miles	≤ 6 Miles	> 10 Miles
January	1.0	2.5	94.7
February	0.1	0.9	97.7
March	0.2	0.7	98.2
April	0	0.1	99.0
May	0	0.2	99.4
June	0	0	99.7
July	0	0.1	99.6
August	0	0	99.9
September	0	0	99.6
October	0.1	0.3	99.4
November	0.2	0.5	98.2
December	0.2	1.2	97.1
Year	**0.2**	**0.6**	**98.5**